DOCUMENT RESUME

ED 125 940 SO 009 167

AUTHOR	Larkin, Robert P.
TITLE	Map and Compass Skills for the Secondary School (Understanding Topographic Maps, Developing Compass Skills, and Orienteering). Instructional Activities Series IA/S-18.
INSTITUTION	National Council for Geographic Education.
PUB DATE	76
NOTE	17p.; For related documents, see ED 096 235 and SO 009 140-166
AVAILABLE FROM	NCGE Central Office, 115 North Marion Street, Oak Park, Illinois 60301 ($1.50, secondary set $15.25)
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	Classroom Games; Earth Science; *Educational Games; Geographic Location; Geography; *Geography Instruction; Instructional Aids; Knowledge Level; Learning Activities; *Locational Skills (Social Studies); Maps; *Map Skills; Physical Geography; Secondary Education; Skill Development; Skills; Social Studies; Teacher Developed Materials; *Teaching Techniques

ABSTRACT

This activity is one of a series of 17 teacher-developed instructional activities for geography at the secondary-grade level described in SO 009 140. The activity investigates the development of compass skills, map skills, and orienteering. It employs the educational-games approach. Given specific exercises and instructions, students become actively involved in classroom and outdoor games and gain understanding of topographic maps while developing their compass and orienteering skills. Specific games that are suggested include a map-photo essay, map symbol relay, hunt-the-penney, school yard compass game, competitive compass game, route orienteering, cross-country orienteering, and score orienteering. Maps and game diagrams are provided. (DB)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

National Council for Geographic Education

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL BY MICROFICHE ONLY HAS BEEN GRANTED BY NCGE

TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE NATIONAL INSTITUTE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

Copyright-1976

INSTRUCTIONAL ACTIVITIES SERIES IA/S - 18

ED125940

MAP AND COMPASS SKILLS FOR THE SECONDARY SCHOOL

(Understanding Topographic Maps, Developing Compass Skills and Orienteering)

by

Robert P. Larkin
Department of Geography, University of Colorado
Colorado Springs, Colorado

Map and compass skills can be presented to students through a series of outdoor-oriented games. This article deals with three sections; map games and exercises, compass skills, and the sport of Orienteering. Throughout, activities are presented which a secondary school teacher can use within the classroom, on the schoolyard, and out in parks or wooded areas. The emphasis is on games which involve the student while instructing him as well. Many of the games can be used as they stand in the article, while sources are given for additional games and instructional aids.

Introduction

Americans, perhaps more than any other cultural group, always seem to be on the move. This is evidenced by the fact that one out of five Americans moves to a new place of residence every year. Americans are always traveling from one place to another via the airplane, bus, automobile, bicycle, and of course, walking. In spite of living in a mobile society Americans have been poorly trained in using maps and the compass. Secondary schools generally spend little time on developing map and compass skills. The purpose of this I.A.S. paper is to present a group of exercises that secondary school teachers can use to teach map and compass skills. The exercises provide for the student to build upon previous knowledge and to be actively involved in games and activities.

SO 009 167

Learning how to use the map and compass will develop knowledge and skills that can be useful in many ways. Many careers (geologist, forester, surveyor, urban planner) require the ability to read maps. Also, many forms of sport and recreation (mountaineering, Orienteering, hiking, sailing, etc.) rely on map and compass skills. School subjects such as earth science and social science can be more meaningful with an understanding of a map and compass, expecially on field trips. Maps make travelling of any kind much more interesting and enjoyable because you can choose where you want to go as well as the most interesting way to get there. These are just a few examples of the value of map and compass skills.

The materials developed in this I.A.S. paper are divided into three parts: (1) understanding topographic maps, (2) developing compass skills, and (3) Orienteering as a way of integrating map and compass skills. Although the exercises are self-explanatory it is suggested that the teacher obtain a book on map and compass skills for reference and more detailed explanations. An excellent inexpensive reference book is Be Expert With Map & Compass by Bjorn Kjellstrom, Charles Scribner's Sons, New York, 1967.

Understanding Topographic Maps

A map is a convenient way of illustrating on paper the features of a particular area of the Earth's surface. Because they are needed for different purposes, maps will differ from each other in the size of the area they cover and the amount of detail they show, and therefore the amount of information they present. The objective of this section is to introduce activities that can be used to familiarize students with United States Geological Survey topographic maps.

Map Symbol Relay

Because maps are symbolic representations of reality it is essential for students to understand the use of map symbols. This first exercise, the Map Symbol Relay, is a means of learning some of the common topographic map symbols. The exercise is an effective way to learn map symbols and also generates a great deal of enthusiasm by the students who participate in the game. Prior to actually setting up the exercise it is useful for the teacher to discuss the many types of symbols used on topographic maps. The symbols are color coded into five general categories: (1) green--indicates form of vegetation, (2) blue--type of hydrographic feature (stream, lake, swamp), (3) red and black--used for cultural features (roads, names, buildings), (4) brown-indicates topographic relief figures, and (5) purple--used on maps that have been photo-revised. It is suggested that the teacher obtain from the Geological Survey a very informative booklet entitled, Topographic Maps. The booklet is free of charge and can be obtained from the Map Information Office, U.S. Geological Survey, Washington, D.C. 20242. Multiple copies can also be obtained free of charge for classroom use and are valuable booklets to use when teaching topographic map skills. After the teacher has briefly discussed the map symbols, as outlined on pages 16 and 17 of the U.S.G.S. booklet, the class is ready for the Map Symbol Relay game.

The procedure for the game is very simple. The teacher must first decide on the important symbols to be learned and then make several sets of maps symbol squares or cards. The map symbol square is simply a card with a drawing of a map symbol on one side and a verbal description of a different symbol on the other side. For example, the teacher selects nine symbols to be learned, they are: (1) intermittent stream, (2) depression contour line, (3) church, (4) school, (5) mine shaft, (6) levee, (7) swamp, (8) orchard and (9) quarry. After selection of the symbols the next step is to draw the symbols on the map symbol card. An easier method might be to draw the symbols on a sheet of paper and then cut the paper up into separate squares for each symbol. Figure 1 is an example of the nine symbols

CUT ON DOTTED LINE

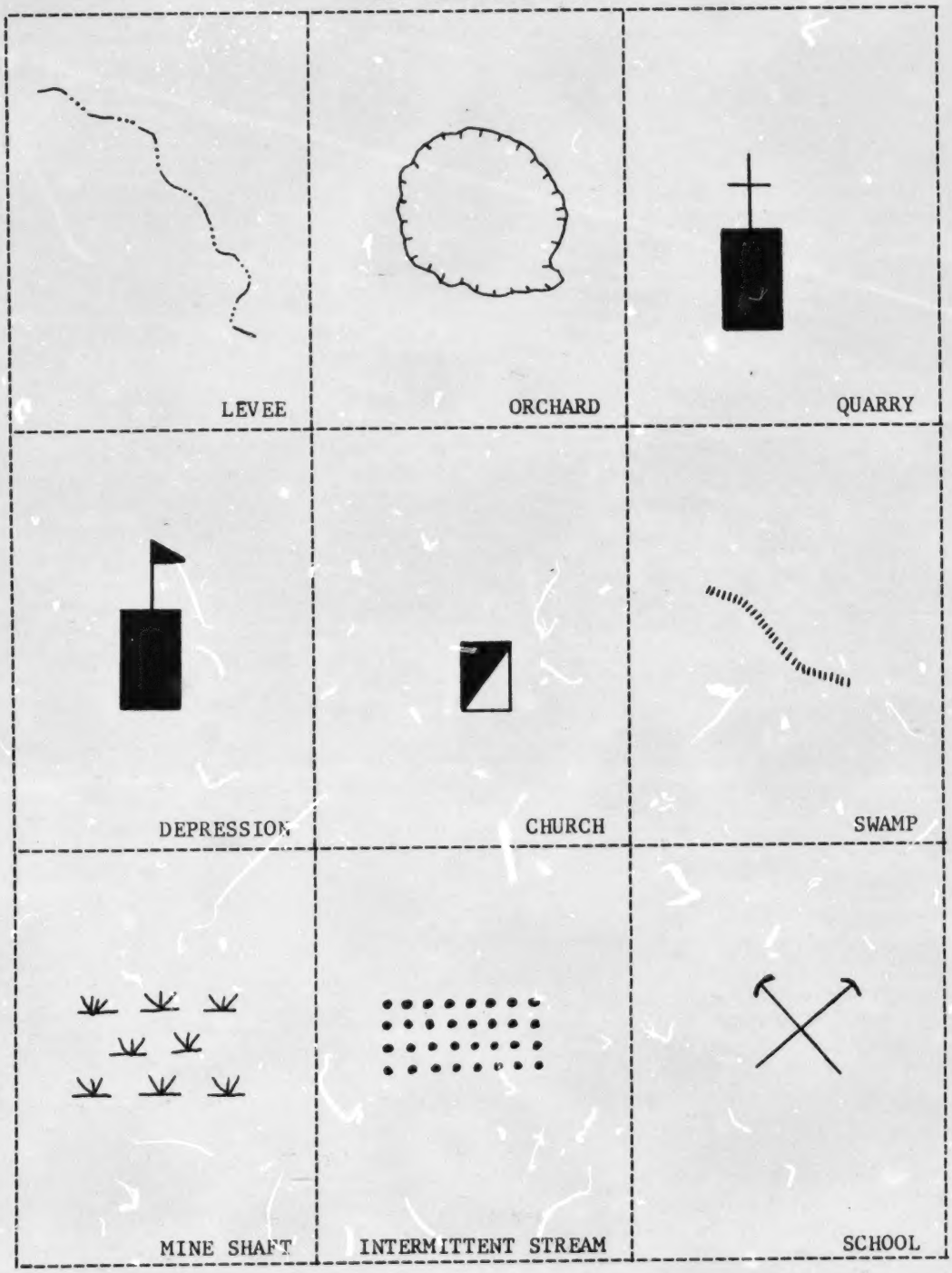


FIGURE 1

previously discussed. On the back side of each symbol card or square the name of one of the nine symbols is written, making sure that the name on the back side is not the same as the symbol on the front. The symbol name in the lower right corner of each square in Figure 1 refers to the name that should be on the back of the square.

The next step is to cut-out the symbol squares. A set of symbol squares will be needed for each team of students. These student teams should include no more than five students. Thus, if there is a class of 20 students four sets of symbol squares will be needed. The easiest thing to do is to photocopy the symbol squares before they are cut-out. The students should next be lined-up along a starting line and the symbol squares should be spread on the floor (symbol up) in front of each team at a suitable distance. The leader of each team is then given a symbol square, making sure all leaders receive squares with the same symbol.

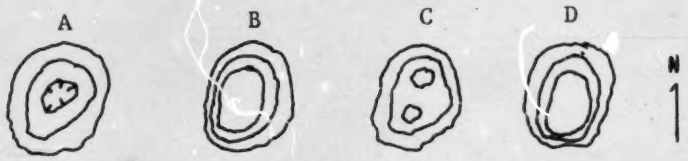
When the leader receives the first symbol square i.e. with the map symbol "intermittent stream" drawn, he or she then flips it over and finds that he must identify the map symbol for "levee" as printed. He then runs to the area where the symbol squares are located, finds the square illustrating "levee", places his card (symbol up) with the rest of the cards, and returns the new card illustrating "levee" to the person next in line. This process is continued until the symbol for "intermittent stream" (the starting symbol) is identified. The team that identifies all the symbols the quickest is the winner. This game generates a great deal of team enthusiasm and any number of symbols can be used.

Contour Line Exercises

A map has length and breadth only. Height of features therefore is shown in a special way using contour lines and spot elevations. A contour line is an imaginary line which connects points of equal elevation above sea level. Each contour line on a map represents a particular height above sea level and the height intervals between them (contour interval) are regular. The contour interval for each map will be shown in the key at the bottom of the map. The shape and position of contours helps the map reader to visualize the actual lay of the land: for example, contours which are relatively far apart indicate that the ground rises gradually and is therefore gently sloping; contours close together show that the ground rises sharply and is therefore steep. Special features, such as ridges and valleys, have their own contour patterns which can easily be recognized with sufficient practice.

The exercise illustrated in Figure 2 was designed to help students understand the nature of contour lines. It is a simple exercise but can be made as complex as desired depending upon the student's level of map sophistication. The task for Figure 2 is to match the contour lines with the proper verbal descriptions. As students become more familiar with contour lines they can develop their own contour lines with accompanying verbal descriptions. Teams of students can develop their own verbal descriptions and contour lines, then trade them with other teams.

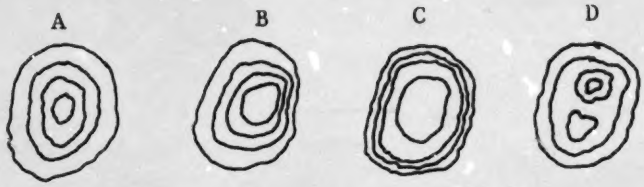
A similar exercise involves matching contour lines with cross-section diagrams (Figure 3). This exercise is designed to give students an understanding of the relationship between landscape elements and contour lines. As in



1. Hill with a steep western side
2. Hill with a depression at the top
3. Hill with a steep southern slope
4. Hill with two summits

Contours	A	B	C	D
Description				

FIGURE 2



Contours	A	B	C	D
Profile				

FIGURE 3

the previous exercise this exercise can be made as simple or complex as desired and a variety of cross-section profiles and contour lines can be developed.

An exercise similar to the one illustrated in Figure 3 can be developed with the aid of a U.S.G.S. topographic map. Cross-section profiles can be matched with lines drawn on an actual contour map. This exercise can be used in a great variety of ways. Students can draw lines on a map and also make matching cross-section diagrams. Teams of students could also trade-off the cross-section diagrams they prepared from different maps to see if other students could match-up profiles and lines.

Another exercise involving contour lines is the "Map Memory Sketch". The class is divided up into teams of four students. A master contour map with four squares drawn on it (Figure 4) is placed on the opposite wall of the classroom. It is best to provide one master map for each team. The object of the activity is to have each team member go to the master map and memorize the contour lines and related topographic features in one of the squares. When the student thinks he knows the contents of the square he returns to the starting area and from memory draws in the topographic features in a blank square. After the first student finishes his square the next student goes to the master map and the process is repeated until all squares are completed. The team that completes the squares the fastest and is the most accurate is the winner. This exercise can be designed for students with varied levels of map skills. Very simple squares can be used for novices while very complex squares can be given to those with considerable skill.

Another exercise that is easy to develop yet is useful in learning topographic map skills is the "Imaginary Map Walk". This exercise involves taking a topographic map and drawing transects connecting points. Each transect should be drawn through areas of variable terrain and cultural features. The student must select a transect and describe in detail the terrain and cultural features he would encounter if he walked the transect. For example, a typical description might read something like this:

> "The starting point is at the intersection of a stream and a hiking trail. You proceed south from the intersection and cross a broad, flat floodplain. At the edge of the floodplain you immediately ascend a steep hill. After climbing approximately 300 feet the terrain levels off and you cross a flat meadow. At the southern edge of the meadow you start to descend a steep slope into a stream valley. Just before you reach the stream you cross a hiking trail. The hiking trail parallels the stream for approximately 2 miles until it ends at a mountain cabin."

The "Imaginary Map Walk" is very easy to develop and a wide variety of terrain and cultural features can be incorporated into this exercise.

Map-Photo Essay

The "Map-Photo Essay" is a useful way to summarize a great deal of information pertaining to topographic maps. The teacher should select a topographic map that has several different terrain features as well as a varied

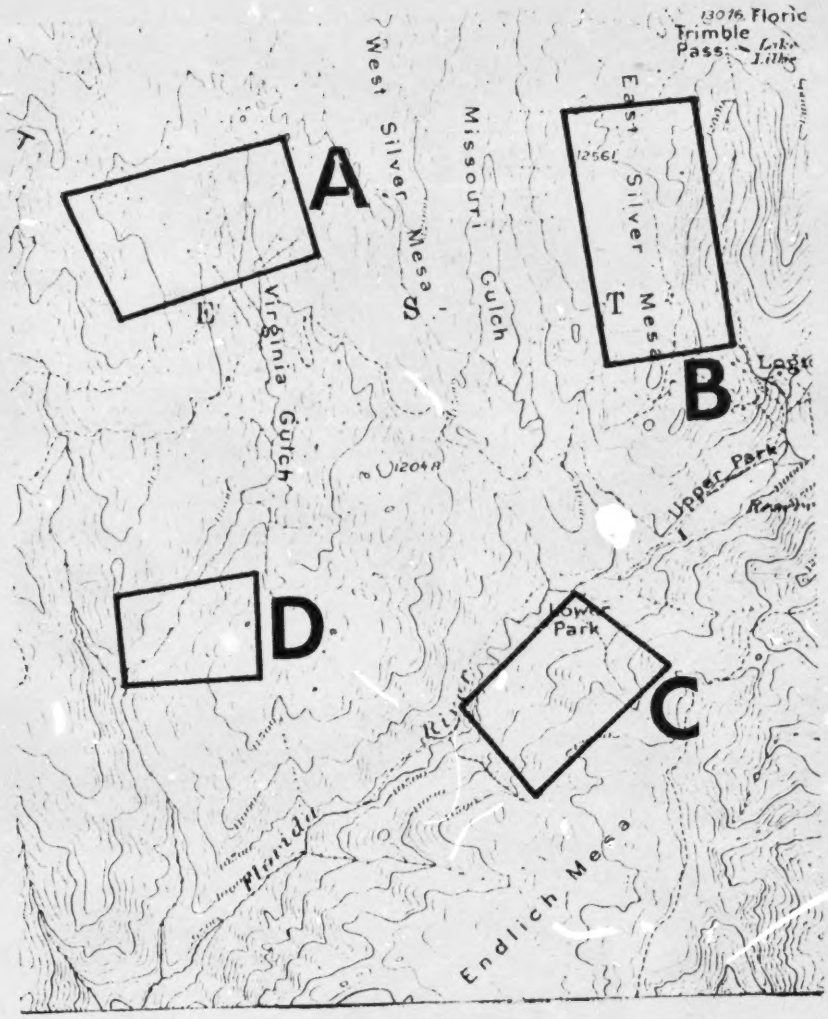

13076 Floric
Trimble Pass
West Silver Mesa
Missouri Gulch
East Silver Mesa
12561
A
B
C
D
Virginia Gulch
Upper Park
Lower Park
Endlich Mesa

FIGURE 4

cultural landscape. The first part of the "Map-Photo Essay" involves distributing the maps to the class and brainstorming the variety of information that can be ascertained by analyzing the map thoroughly. Speculations concerning climate, vegetation, geology, economic activity, population dynamics, and cultural characteristics of the population can be made by the students. A discussion of the many different kinds of information that can be gleaned from topographic maps is an extremely useful exercise. From the analysis of a topographic map the students get a mental picture of the region portrayed on the map.

The next part of the "Map-Photo Essay" involves showing a series of slides that were taken in the map region. These slides can be used to either confirm or reject the speculations made by the students. Students find it interesting and exciting to look at the area portrayed on the map. A comparison of the mental picture they developed and the real world shown in the slides usually leads to many questions about the quantity and quality of information from topographic maps. It is also a useful learning exercise to show a slide of a portion of the area covered by the map and then have the students see if they can guess where on the map the slide was actually taken.

If time and resources are available a good exercise involves taking the students on a field trip in the local area and comparing the real world with the topographic map of the local area. Even if it is not possible to visit or obtain slides of a region portrayed on a topographic map it is often useful to analyze a map in order to see just how much information is available from the map.

Developing Compass Skills

An important aspect of teaching compass skills is the instructional sequence of activities. The following compass activities should be taught in sequence to insure maximum clarity and ease of teaching. The activities have been designed around a compass that has a moveable protractor dial and a square baseplate. The Polaris (TYPE 7) compass manufactured by the Silva Compass Company is a good, inexpensive compass well-suited for classroom use.

The basic compass skills of setting, taking, and following a bearing should be introduced as quickly as possible. Setting a bearing is a simple operation and involves nothing more than setting the compass dial on the bearing given to the students by the teacher. It is best to start with the cardinal directions: North, South, East, and West. Have the students set their compasses on each of the four cardinal directions and then in each case turn their bodies in that direction. After the cardinal directions are explained and understood the next step is to give the students a variety of compass bearings. For students that are familiar with the 360 degree circle of the compass rose problems such as "set your compass at 450 degrees" can be interesting. Obviously, 450 degrees is equal to the full 360 degrees of the circle, plus an addition of 90 degrees; thus, the bearing would read 90 degrees or due east. This dial-a-bearing game could have a competive aspect with the teacher recognizing the first student that sets a bearing and faces in the appropriate direction.

The next skill to be developed is that of taking a bearing from a landmark. The students first must face a landmark (tree, building, etc.) with the compass's direction of travel arrow pointing toward the landmark. They next orient the compass by turning the compass housing until it lines up with the magnetic needle. For teachers unfamiliar with the compass it is suggested that they refer to the book Be Expert With Map and Compass by Bjorn Kjellstrom. This book goes through a step by step procedure relative to compass use.

Hunt-The-Penny

The object of this game is to develop the students' ability to set bearings on a compass and follow the selected bearing. The emphasis of the game is on developing simple compass skills and not on distance or map skills. The student picks a spot in an open field or schoolyard and marks the spot with an object (book, penny, etc.). The purpose of the game is to start at the marker and after following a square course return to the same marker (Figure 5). For example, you start with a bearing of 85 degrees. After walking ten paces in that direction the student stops and adds 90 degrees to the original bearing. The new bearing is thus 175 degrees. The student then walks another ten paces in the new direction (175 degrees) and stops again. After repeating this process two more times the student has described a square and hopefully will be back at the starting point. Many varieties of this game can be developed. For example, by adding 120 degrees on each of three legs a triangle is described. Likewise, add 60 degrees for six legs, and so on. As more legs are added the game gets more complex.

Schoolyard Compass Game

This is a compass game which may be played in any open area such as a park, football field, or a gymnasium. In order to play, the participant must be able to set a compass bearing and follow a bearing. The course consists of eight labeled markers placed in a large circle. While playing the game, all players are contained in the circle. Nine stakes or markers are needed with one of the stakes unlabeled and the others labeled with the following letters: I.O.U.L.Z.E.A.P. The unlabeled stake is placed in the center of the course (Figure 6). The remaining labeled stakes are placed 50 feet from the center stake at the appropriate compass bearing. The radius of the course may be changed to suit either the available space or the number of players participating in the activity. Setting up the game in a wooded area, with bushes, streams, and rocks will make the game more interesting and challenging.

The participant in the game receives an instruction card that gives the starting position as well as bearings which direct him from marker to marker around the course (Figure 7). The player copies down the letter on each marker along his route and at the finish a six letter code word is produced. This code word is checked against an answer sheet and if the student player followed the correct bearings his code word should be the same as the one on the answer sheet. This game is very simple to set-up and play, however, the teacher may wish to purchase instructions and score cards from Silva Company, 2466 Stae Rd. 39 N., La Porte, Indiana 46350.

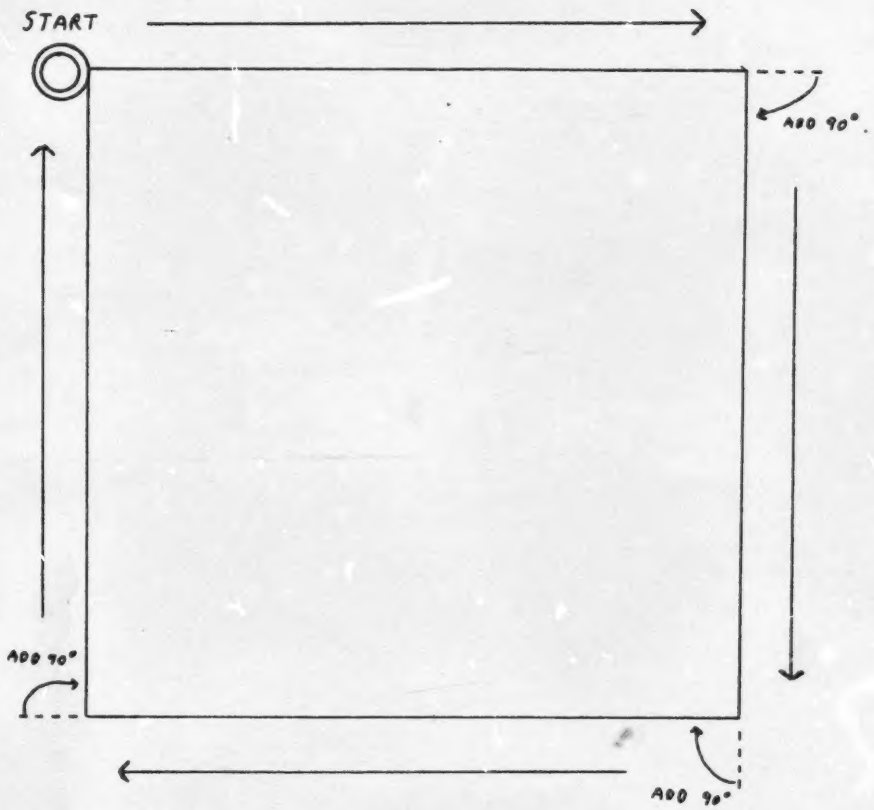


FIGURE 5

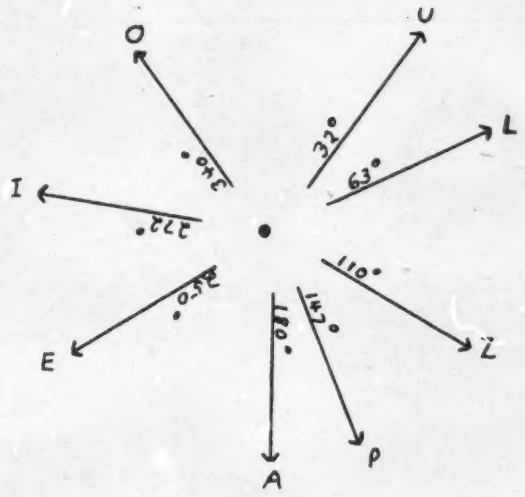


FIGURE 6

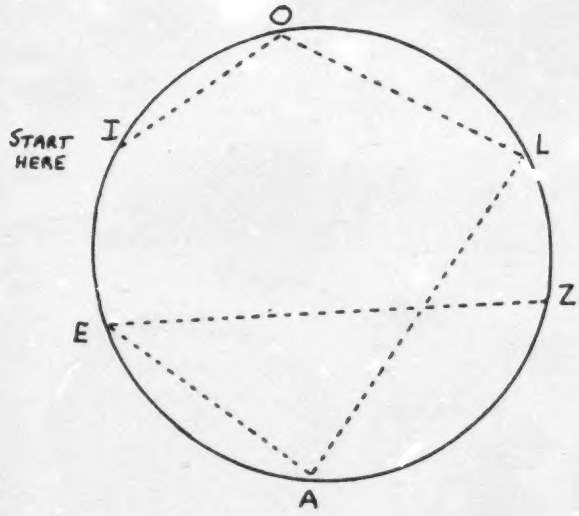


FIGURE 7

Competitive Compass Game

The "Schoolyard Compass Game" and "Hunt-The-Penny" are designed to develop the skills of setting a compass bearing and then following the bearing on the ground. The element that has been missing so far is distance. The "Competitive Compass Game" combines the concept of the compass bearing with distance. The first step is to mark off a 100 foot transect in an East-West direction. The transect is then divided into five foot intervals which are numbered consecutively from 1 to 20, with number 1 on the marker farthest West. An alternate method is to fasten tags five feet apart on a 100 foot rope and then stretch the rope in an East-West direction with the number one on the West end (Figure 8).

After the transect or rope is set-up each student should check the length of his pace. A pace represents two steps, and can readily be measured by counting every time the right foot touches the ground over a given distance. For example, if it takes twenty five paces for the 100 foot distance then each pace will be four feet.

To start the activity each student is given a score card that indicates a starting point along the transect and three legs to follow, each with a bearing and distance. For example (Figure 8), a student starts at number 4 and is instructed to take a bearing of 300 degrees and walk 180 feet for the first leg. The second leg involves a bearing of 88 degrees and a distance of 184 feet and the final leg has a bearing of 190 degrees for 103 feet. After the student goes through all three legs he marks on his score card the number of the marker on the transect or rope nearest to the actual destination he has reached. The correct destination is indicated on the back of the score card and the student can see how close to the correct destination he came. If the student reaches a correct destination his score is 100 for that course. Five points are deducted for each marker he is away from the correct destination. For example, if a student was supposed to finish on number 11 but actually finishes on number 8 he is 3 markers or 15 points away, giving him a score of 85.

This game is both fun and educational and students enjoy participating in the activity. The teacher can work out on paper several legs for the course or the game is available at a very small cost from the Silva Company and can be used many times.

Compass Race

This final activity combines all the previous compass skills into an exciting game. Markers are set-up at selected points in a wooded area, schoolyard, or any open park area (Figure 9). The object of the game is to start at control number one and go to all the controls and return back to the starting area as quickly as possible. For example, at the starting area is a card that gives the bearing and distance to the first marker. The student locates the first marker from that information and directions to the next marker (Number 2) are found at that first marker. The distance between markers can be based on the time available for the activity and the skill level of the students. Thickly-wooded areas, longer distances, and rough terrain all serve to increase the difficulty of the game for more advanced students. An important feature of this game is the lack of expensive and sophisticated materials needed to run the activity. In situations where maps aren't available students can still get outdoors, use their compasses, and find their way successfully through a wooded area or park. Also, the

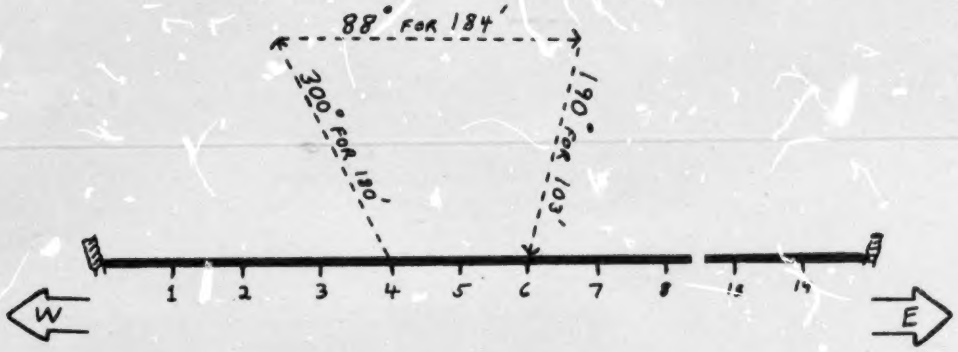


FIGURE 8

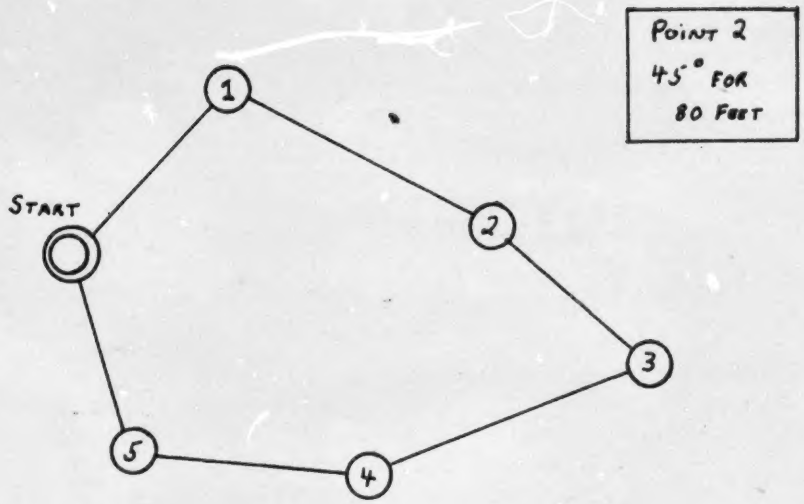


FIGURE 9

ability to estimate distances and use the compass is strengthened.

Orienteering as a Method of Integrating Map and Compass Skills

Orienteering is a rapidly growing sport that combines map and compass skills with cross-country running. Although Orienteering can be competitive, it loses nothing in excitement and enjoyment if it is done without competition. A course can be chosen and completed solely for the sense of achievement it gives you at your success in finding your way confidently and safely over unknown ground entirely by your own efforts. Similarly, it need have no other aim than enjoyment of the pleasures of the countryside with the added interest of finding your way among them. Orienteering has all the adventure associated with pathfinding through unknown country but, because it is organized and carried out under carefully-controlled conditions, there is little risk involved.

From a pedagogical standpoint Orienteering is an exciting way to learn map and compass skills. It involves direct application of classroom and school-yard activities. Advanced orienteering students have to be familiar with many aspects of map-reading including direction, declination, scale, symbols, orientation, and of course a thorough knowledge of contour lines is important.

Route Orienteering

Route Orienteering is a simple form of Orienteering but is useful for those newly introduced to map and compass skills. It involves taking a map of the local area and drawing an Orienteering route on it. The route should follow only paths, tracks, roads, and other easily recognizable landmarks. Each student receives a map with a previously marked route on it. The student must follow the route and along the way will encounter controls or markers at which he either copies down a code letter or punches a control card. Another variety of this activity could involve the students marking the control site on their map and the student who wins is the one who has the control point sites most accurately drawn on his map.

Cross-Country Orienteering

Cross-country Orienteering is the most popular form of Orienteering. In this type of Orienteering competitors leave a starting area at intervals, usually of one minute, and have to find their way to a series of control points. These points are placed on a map which is given to the competitor just before leaving the starting area (Figure 10). The object of the activity is to find each control point and return to the starting area as fast as possible. Each participant is timed and the fastest one around the entire course is the winner.

The control point is a flag or marker of some kind which has a letter or number attached. When the participant reaches a control point he marks down the number or letter on a scorecard. In some cases a punch is attached to the marker and the participant punches his scorecard to prove he was at the control point.

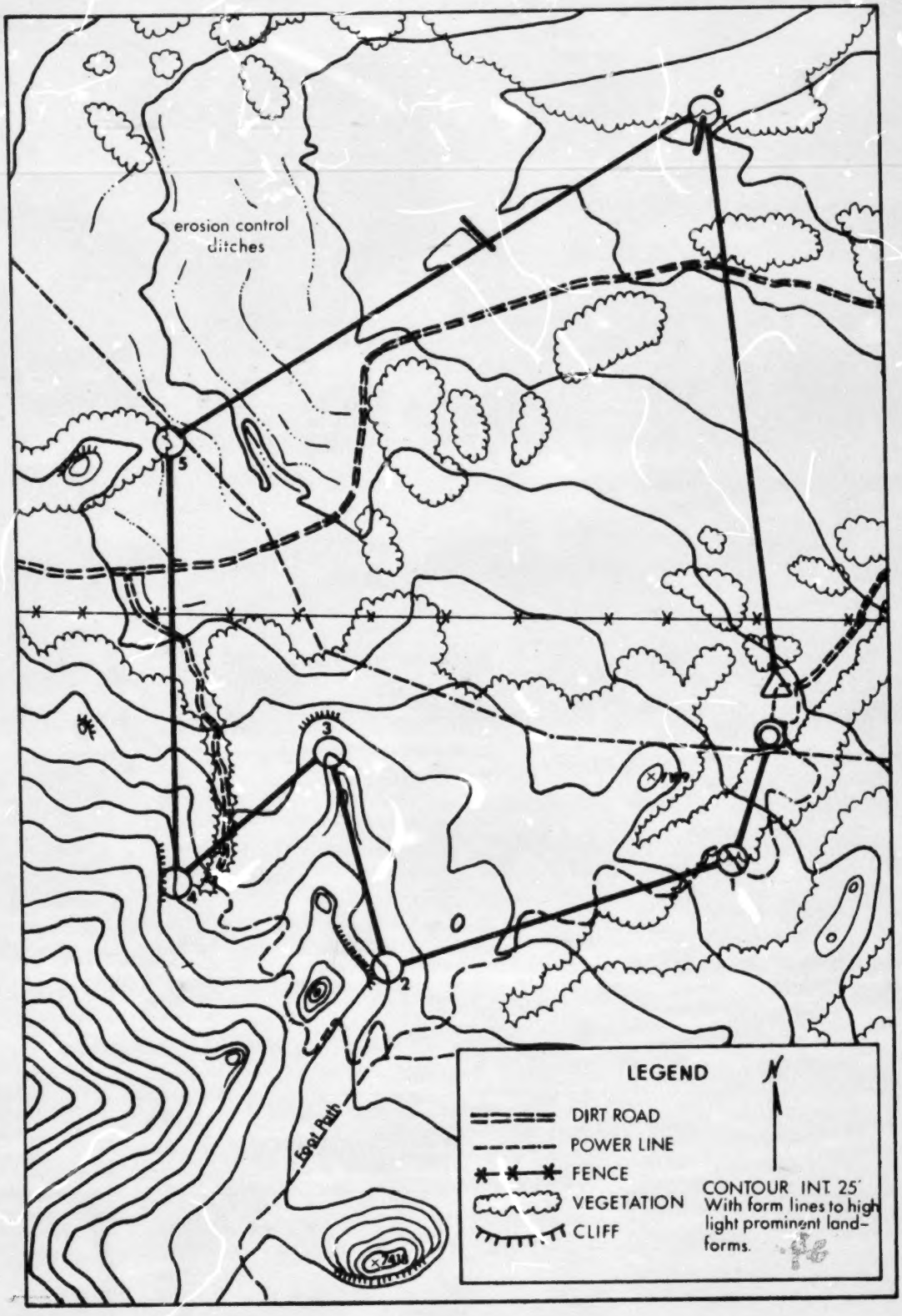

erosion control ditches
6
5
3
4
2
1
Foot Path
×240
LEGEND
DIRT ROAD
POWER LINE
FENCE
VEGETATION
CLIFF
N
CONTOUR INT 25'
With form lines to highlight prominent land-forms.

FIGURE 10

Several factors should be kept in mind when setting up an Orienteering meet. First of all, the markers should be relatively easy to find, particularly if it is the first attempt by the students. Second, don't make the course too difficult. Short, easy courses build confidence, especially for those just learning map and compass skills. Finally, make it fun for the students. Try not to overemphasize the competitive aspects of the game, instead emphasize the learning skills associated with the map and compass. It might even be useful in some cases not to time the participants, but let them find the markers at their own pace, even in groups or pairs.

The actual field experience with map and compass involves application of many skills. The heart of Orienteering is choosing the route you will take between control points. A poor route-choice decision will waste both time and energy. The shortest distance between any two control points is the straight line but students learn very quickly that many other factors must be considered and the straight-line route is rarely the one chosen. Other factors such as: the nature of the ground, obstacles like swamps or rivers, cliffs, an easier route not too far away, the presence of plenty of landmarks especially continuous features like paths and fences, are all important factors to consider. As students become more familiar with the map and compass their Orienteering ability progresses accordingly.

If actual field experience cannot be accomplished it is possible to work with Orienteering maps in the classroom and still develop some of the necessary Orienteering skills. For example, a map with an Orienteering course outlines on it (Figure 10) can be given to the students and they can outline on the map the route they would follow if they were to actually run the course. The students can then discuss their choice of routes relative to the map skills they learned.

Score Orienteering

"Score Orienteering" is another type of Orienteering activity. It is similar to cross-country Orienteering in that control points are marked on a map. In score Orienteering however, the control points do not have to be visited in any specified sequence. Each control marker is put on a map and a corresponding number of points are assigned to each marker. The control markers worth the most points are those that are the most difficult to reach, whereas the easiest markers to reach have a lower value. A time limit is set and announced to the participants at the start. Points are deducted for every minute beyound the time limit that the participant finishes. Score Orienteering offers some advantages over other forms of Orienteering: (1) it can be held in reasonably open country, (2) students of all levels of skill can compete together, and (3) the event can be confined to a comparatively short time period (Disley, 1973).[1]

Orienteering type activities can be of great value in teaching map and compass skills (Adams, 1973)[2]. Meaningful practical experiences can be provided which complement standard classroom techniques now used in teaching map and compass skills. "In essence, the approach here is simply the introduction of a game situation, Orienteering, as a vehicle for teaching map and compass skills". (Larkin, 1975)[3].

[1] J. Disley, Orienteering (London: Faber and Faber, 1967), p. 170.

[2] W. P. Adams, "Geography and Orienteering," The Journal of Geography, LXXI (November, 1972), 473-483.

[3] R.P. Larkin, "Map Skills and Orienteering," Great Plains-Rocky Mountain Geographical Journal, 4 (1975), 74-82.